REPORT ON THE MISSION TO THE

COCONUT INDUSTRY BOARD OF JAMAICA

17-22 May 2010

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Coconut Lethal Yellowing and Citrus Greening

CONTENTS

Acknowledgements

Particular thanks to Drs. Basil Been and Wayne Myrie from the Coconut Industry Board for their warm hospitality and the time they gave up for all the trips and for organizing some very interesting visits to various parts of Jamaica.

Thanks also to Mr Newman, the General Manager, for receiving me at the Good Hope estate with great courtesy.

Lastly, many thanks also to Mrs Aminata Eluther-Wesley from the French Embassy in Kingston who has followed our collaboration with the CIB for several years now with particular interest and attention, and who enabled this mission to go ahead.

Schedule

Monday 17/05: Travel Montpellier-Paris-Miami- Kingston

Tuesday 18 /05: Visit to the eastern tip of the island; Fair Prospect variety performance trial

Wednesday 19/05: Discussions at the CIB. Research on the vector, host plants, epidemiological surveys, *Phytophthora* problems, technical laboratory issues, CFC project.

Thursday 20/05: Trip to the western zone of the island. Tour of the Good Hope estate, overnight at Montego Bay

Friday 21/05: Tour of the Barton Isle seed garden

Saturday 22/05: Travel Kingston-Miami-Paris

Sunday 23/05: Paris-Montpellier.

Introduction

Jamaica has without a doubt the most organized entity in the Caribbean/Latin America for the coconut supply chain: the Coconut Industry Board (CIB). It is thanks to this board that the coconut supply chain still exists in the country in 2010 despite the two devastating bouts of Coconut Lethal Yellowing (CLY) that affected Jamaica in the 60s-70s then the 90s-2000s.

The CIB provides a true link between farmers and research. In addition to its work on agricultural aspects, the CIB worked with British researchers present in Jamaica in the 70s in the search for the vector(s) and on plant genetics/breeding to control CLY. At the beginning of the 80s all hope was placed in "Malayan" dwarf varieties - Yellow Dwarf (MYD), Green Dwarf (MGD) Red Dwarf (MRD) - and their hybrid known as the "Mayan", with the "Panama Tall" coconut palm. They were considered to be CLY-resistant. All replantings from the end of the 70s / beginning of the 80s were carried out with MYD or Maypan palms. However, at the end of the 80s, worrying percentages of disease cases were being reported on Malayan Dwarf palms in Florida, where the same CLY "strain" was rife. In Jamaica, at the end of the 90s, CLY was causing greater and greater damage in MYD and Maypan plantations. In less than 10 years, several of these plantations, considered to be resistant, were 100% destroyed.

It therefore became essential to resume the basic research on each of the three components of this type of disease: the host (coconut), the vector (insect, yet to be identified in Jamaica... the same as in Florida, or another?) and the pathogen (phytoplasmas).

This fresh research was launched during a meeting under the aegis of the FAO and the Common Fund for Commodities (CFC) in Kingston in January 2002, attended by two CIRAD researchers (F. Rognon - also Director of Biotrop - and M. Dollet). That meeting led on to an international project involving Jamaica, Mexico and Honduras. CIRAD was involved in this project via one of its entomologists posted to Mexico at CICY (Centro de Investigaciones Cientificas de Yucatan). It involved research on the CLY vector in Mexico. In addition, two researchers from research unit UPR 29 (L. Baudouin – geneticist - and M. Dollet) were appointed as scientific advisors to the project.

CIRAD and CIB, which had already worked together on genetic aspects (notably through work in Ivory Coast via the *Institut de Recherches pour les Huiles et Oléagineux* –IRHO- subsequently taken up by the CIRAD Tree Crops Department) then intensified their collaboration, with support from the CIRAD Training Service (DESI) and the French Embassy in Jamaica.

CIRAD (M. Dollet, L. Baudouin, P. Lebrun) hosted and supervised a young researcher from CIB, Wayne Myrie, in connection with his research for a PhD, which he successfully defended in January 2005 at the University of the West Indies in Kingston (M. Dollet was on the thesis panel). Several joint papers have been presented at international conferences and have been published in renowned scientific journals (See annex 1).Between 2002 and 2009 several CIRAD missions were undertaken in close collaboration with the French Embassy and CIB, for pathology, entomology, agronomy and genetics aspects (annex 2).

This current mission was mainly intended to take stock of CIB/CIRAD collaboration in line with the recent developments arising from research on Lethal Yellowing type coconut diseases being conducted on either side, and in line with the phytosanitary condition of Jamaican coconut plantations.

VISIT TO THE EASTERN REGION

Fair Prospect varietal performance trial.

This plot, containing several varieties and hybrids, long remained disease-free. A few sporadic cases of CLY occurred without the disease spreading in the plot. It was virtually unaffected by the bout of CLY in the 70s. It only really started being attacked at the beginning of the 2000s. Some varieties could be considered, at a given moment, as possible sources of resistance as they were not affected by CLY, whereas others were severely affected. But, in fact, the difference largely came from the single direction of disease spread, from the coastline inland. The final outcome for this Fair Prospect performance trial shows that none of the tested varieties resisted the bout of CLY in the 90s-2000s (Fig.1-2). It can be particularly noted, as virtually everywhere else, that Malayan Yellow Dwarfs and Maypans are also killed by CLY. The CIB has handed back this land, part of which will be used for a building project.

Errol Flynn Estate

It is worth noting that the Errol Flynn Estate (Maypan) on the other side of the road from the Fair Prospect plot, even further inland, was only affected well after the Fair Prospect variety performance plot (Fig.3). The disease there spread from the roadside (Fair Prospect plantation side) inland. To my knowledge, since the first mission in 2002, the palms in this plantation have never been handsome, suffering in particular from deficiencies that have never been corrected. They have grown quite slowly. It may be that the vector present in this zone left these deficient palms alone in favour of the palms receiving better upkeep in the performance trial opposite. Observations in Florida in the 70s showed that the vector (identified as *Myndus (Haplaxius) crudus*, Cixideae) preferred to land on and feed off green and healthy coconut palms, rather than weak palms.

Fig. 1.

Fig.2

Fig. 1 and Fig 2. What remains of the CLY variety performance trial at Fair Prospect in May 2010

Fig.3 Errol Flynn Estate (northeast coast).

Michael Black's estate/eradication

A return visit was made to Michael Black's estate, which now has an established reputation for very good management, with early eradication of diseased palms, which apparently seems to be the reason for the very low CLY percentage in this estate. Eradication is carried out right from the nut-fall stage (prior to yellowing) and the fronds are burnt. To ensure the effectiveness of their methodology, they also eradicate diseased palms from neighbouring plantations.

For several years, the eradication of any new case of CLY has been systematic, thanks to regular phytosanitary surveillance. The grubbed up palms are also replanted. This practice seems to be successful at this estate: 6 cases of CLY between January and May 2010 , whereas there were 57 in 2009 and between 62 and 238 in earlier years (the first cases appeared in 1997).

Armed with this experience, CIB takes care of eradicating new cases of CLY on certain plantations where CLY is beginning, and supplies Maypan nuts for replanting.

Red Mite problem

The mite *Raoiella indica* Herst (Red Palm mite-RPM) first appeared in Jamaica in 2007. This mite is especially known in Asia, the Indian Ocean and the Middle East. In 2004, it was detected for the first time in the Caribbean, in Martinique. It then spread to Saint Lucia and Dominica in 2005, then to Puerto-Rico and the Dominican Republic in 2006. This microscopic mite (0.3 to 0.5 mm with larvae measuring 0.2 mm) establishes colonies on the underside of leaflets (Fig.4) The wet season - high humidity - would seem to be detrimental to its propagation.

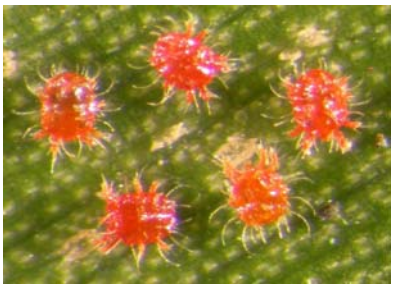

Fig. 4 Red Palm Mite (*Raoilla indica*). Photo R. Duncan.

RPM colonies cause localized yellowing. The existence of numerous colonies causes a sort of chlorosis turning leaflets yellow then brown. As it is the lower fronds that are usually affected first, the symptoms caused by RPM can be confused from a distance with those of CLY. In countries where CLY exists, this is not really a great problem as most farmers recognize CLY as the syndrome progresses (but … not all of them). However, this is more problematic in countries yet to be affected by CLY. This situation has been encountered in Guadeloupe, located 150 km from Nevis where CLY appeared in 2006. At the end of 2006, some young coconut palms displayed yellowing symptoms on lower fronds that could have been interpreted as cases of CLY, but which were due to RPM (Fig. 5). The same situation prevailed on Saint Lucia.

Fig.4. Yellowing symptoms on lower fronds caused by Red Palm Mite in Guadeloupe in November 2006.

During this mission in Jamaica, the distribution of the mite was seen to be very uneven. In particular, old coconut palms on the hills are often very green and do not therefore seem to be affected. But this problem needs to be taken seriously, as it can cause a drop in yields, and it is a much feared quarantine organism that prevents exports. The services of the Ministry of Agriculture have apparently identified one (or more?) natural parasite(s), but their effectiveness as a means of control has yet to be demonstrated. Some Indian publications report on successful biological control of these mites. It should be noted that this mite is fairly polyphagous. It is known on more than 30 species of palms and other plants (banana, *Heliconias, Alpinia* sp.).

Unfortunately there are fewer and fewer mite specialists, notably in the Caribbean. Dr J. Etienne, now retired, in Guadeloupe is one of the few people who might be able to be of service. In India, natural enemies of this mite have been identified and results have apparently been obtained against it (see, for example, the review by Pena et al. 2006). As Jamaica is a small island, it can be imagined that biological control is a possibility.

Miscellaneous

Coconut water

The small pilot coconut water processing factory installed on Coconut Industry Board premises by the FAO is still not satisfactory. The filtration system would seem to retain too many sugars and the taste of the product is not that expected by experienced consumers who are used to opening their own nuts to obtain their coconut water. Consequently, the CIB shop now sells coconut water by opening the nuts in front of the customer. According to Basil Been, the UHT process used in Brazil does not appear to be adapted to connoisseurs either, as the water apparently has a caramel taste.

It should be noted that the shop selling coconut products at CIB in Kingston, which sells very varied products (copra oil, virgin coconut oil coconut milk, desiccated coconut, various biscuits, etc.) is a great success with a constant flow of customers.

VISIT TO THE WESTERN REGION

Visit to the Good Hope Estate (Trelawny, near Montego Bay)

At the outset, this was a coconut grove that suffered many losses during the bout of CLY in the 60s-70s which converted to citrus. When threatened by the Tristeza virus, virus-resistant rootstocks were used to replace the originals. However, the arrival of Greening or Huanglongbing disease (HLB) in the Caribbean after Florida in 2006 did not spare Jamaica. The disease was diagnosed in the estate in 2010 during a visit by experts. It is transmitted by a vector insect – Psyllidae. The psyllid incriminated in this region is *Diaphorina citri*. A short tour of these citrus plantations showed that HLB has not caused a lot of damage yet (Figs. 5, 6 and 7). Some psyllids were found, but in very small numbers. A few trees did not have any at all, the maximum seen being three per tree. This suggests there could be some natural enemies of psyllids. This assumption was confirmed a little later at the Plant Protection Office, Ministry of Agriculture, Bodles Research Station, Old Harbour, St Catherine. This service intends to launch mass rearing of the vector's parasites, but for the moment the resources available are fairly limited. Furthermore, it needs to be pointed out here that the vector is very efficient in transmitting HLB, so even if psyllid numbers are small, one cannot just settle for that result, as the disease will continue to spread if no "sanitation" measures are envisaged: eradication of diseased trees, even if they do not yet have any obvious symptoms (PCR diagnosis test), nursery checks and installation of new nurseries under insect-proof netting.

Fig. 5

Fig. 6

Fig. 5 , Fig. 6, Fig.7 Greening or HLB symptoms in the Good Hope citrus estate.

The unexpected consequence of the arrival of HLB in this region of Jamaica, where very few coconut palms remain, hence where CLY is not virulent, is that the Good Hope estate is reverting back to coconut. (Fig.8). The seedlings come from the CIB (Maypan derived from crosses between the Malayan Green Dwarf and the Panama Tall). The CIB is committed to supplying these new coconut palms, but is having trouble keeping its promises in good time, given the limitations of its seed garden.

It should be noted that some of the recently planted coconut palms were doubtless not large enough to be planted out. In addition, the seedlings are transported with bare roots (not in nursery polybags), which further increases planting shock when seedlings are too young. All that can be suggested is what CIRAD has always recommended and which has proved its worth elsewhere: polybag nurseries and seedling transport in the polybag right up to the planting hole in the field (Bourgoing 1991, Wuidart 1981) – (See Annex 3,4 and 5).

Barton Isle seed garden

At the outset, this seed garden was intended to produce Maypan palms considered resistant to CLY. Its location in the centre of Jamaica, in a region where there are no coconut palms, was chosen to prevent pollen other than that from the male parent (Panama Tall, taken from other sites) from interfering with pollination on the inflorescences of Malayan Yellow Dwarf palms. But this location has a downside: the drought that prevails in this part of the island.

Fig. 8. Maypan palms derived from the Malayan Green Dwarf at the Good Hope estate.

Irrigation is therefore necessary, but that raises various problems and is not without a cost. Moreover, it is distant from zones in which coconut palms are planted. The CIB is therefore wondering whether it might not be better to abandon this site and set up another one under better agro-ecological conditions. I totally agree with that, particularly as the new hybrids sought by consumers are based on the Green Dwarf (the dominant yellow colour is not appreciated by farmers), the Yellow Dwarf palms have been poisoned, and only Malayan Green Dwarf palms remain in Jamaica, but not in sufficient quantities for the country's needs. As for the Yellow Dwarf palms in the past, a degree of heterogeneity can be seen in stem morphology and it is therefore recommended that the CIB check the genetic origins of its male parents, as we did together for the Yellow Dwarf palms (Lebrun *et al.* 2008).

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Annex 1

Joint CIB-CIRAD article and papers between 2006 and 2010.

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Myrie W., Harrison N., Dollet M., Been B. (2007) – Molecular detection and characterization of phytoplasmas associated with lethal yellowing disease of coconut palms in Jamaica. First International Phytoplasmologist Working Group Meeting http://dx.doi.org/10.1007/s11295-007-0093-1. Bologna (Italy) November 12-15. Bulletin of Insectology 60 (2): 147-148

Myrie W., Paulraj L., Dollet M., Wray D., Been B. (2006) - First report of Lethal Yellowing Disease of Coconut Palms caused by Phytoplasma on Nevis Island. Plant Dis. 2006 - 90: 834

Myrie W., McLaughlin W., Harrison N., Dollet M., Been B. (2006) - Molecular diagnosis and characterisation of phytoplasmas associated with lethal yellowing disease of coconut palms in Jamaica. 16th International Congress International Organization for Mycoplasmology (IOM) http://dx.doi.org/10.1007/s10681-007-9568-2 - Cambridge, United Kingdom. 9-14 July 2006

Annex 2

CIRAD missions in Jamaica.

J.L Dzido. Entomology mission (CLY vector). 13-20/06/2009

X. Bonneau. Agronomy mission (nurseries, seed gardens, crop management sequences). 19-23 May 2008

L. Baudouin. Genetics mission (germplasm characterization by molecular markers, genetic diversity, Fiji Malayan Field Caenwood project). 19-27 June 2007

M. Dollet. Plant pathology mission (disease spread, reservoir plants, molecular characterization of phytoplasmas). 29 October to 5 November 2006

M. Dollet. Thesis panel for Wayne Myrie from CIB. Assessment of the CLY problem; field visits**.**

J.F Julia. Entomology mission (vector research). 2-9 May 2005

M. Dollet. Plant pathology mission (disease spread, reservoir plants, molecular characterization of phytoplasmas). 18 to 27 March 2004.

M. Dollet. FAO-CFC meeting on CLY. 12 to 18 January 2002.

Annex 3

From the book :

COCONUT

Apictorial Technical Guide

For Smallholders by Raymond Bourgoing

Ed. By D. Benigno

ISBN 979-8213-00-9

IRHO/CIRAD 1991

PLATE 7.1

PLANTING COCONUT HYBRIDS IN UPLAND AREAS - 1

1-3. Distribute one seedling per planting hole. With a bucket full of TSP and a measuring cup (350 gr capacity), measure 350 gr of TSP, pour it on top of the topsoil heap and mix as homogeneously as possible.

4. With a 50 cm long bamboo stick measure the planting depth required from the bottom of the polybag to the white ring or mark on the stem of the seedling.

5. Mark the level on the stick with the thumb. Place the stick in the planting hole to check against a horizontal stick (80 cm in length) placed on top of the hole whether the depth of the hole is correct or not. If the hole is not deep enough, dig it to the proper depth. If the hole is too deep, adjust the depth by filling with topsoil scraped from the surrounding circle; compact it before placing the seedling in the hole.

REMARKS:

a. Transplant coconut hybrids when they are six to ten months old. If hybrids are transplanted before the age of six months, they are not developed enough to show significant differences for sound selection, and if transplanted when more than ten months, the seedlings are too old and too difficult to transport. It is highly recommended therefore that the transportation and planting schedule be properly organized.

b. Inform farmers one month in advance before delivering the seedlings. Do not deliver seedlings to those farmers who have not yet finished preparing their land.

c. Schedule plantings when the rainy season is well settled, i.e. after a minimum of 110 mm rain in a 15-day period.

d. Organize farmers into planting groups and sub-groups and deliver just enough seedlings to plant in a 2-day period.

AVOID DELAYS OF MORE THAN 48 HOURS IN PLANTING.

e. Check the size of the holes just before planting. Bring up to standard those below the recommended depth and width.

f. Prepare in advance the measuring cups for TSP fertilizer application at planting time.

PLANTING: 40 PLANTS / MAN-DAY

PLATE 7.1

1

2


3


4


5

...by R. Bourgoing

PLATE 7.2


6


10


7


9


8

Photos by R. Bourgoing

PLATE 7.3

PLANTING COCONUT HYBRIDS IN UPLAND AREAS - 2

6. With a sharp knife, slit open the bottom of the polybag, starting on one side five cm above the bottom, following the seam at the bottom and ending five cm above the bottom on the opposite side.

7. Pull the two flaps outward and fold them over. Then lower the polybag carefully into the center of the hole. Be sure to hold the seedling properly with its stem on one hand and the bottom (roots and soil) on the other hand to avoid breakage. Observe closely the well-developed root system and the water-saturated earth clod.

8. Step into the hole beside the seedling and check carefully whether the seedling is set vertically at the center of the hole. Then holding the seedling with one hand and the hoe with the other, slowly fill the hole with the topsoil /TSP mixture up to the cut portion of the polytbag.

9. Compact the mixture by treading around the seedling, taking care not to break its petioles and leaves while moving around.

10. Continue pulling up the polybag with both hands until only a third is left, then continue filling the hole with the soil and TSP mixture.

Annex 4

Conseils de l'I.R.H.O. – 216

Oleagineux 1981 vol. 36 n°7 W. WUIDART

Pratique agricole
Agricultural Practice
Práctica Agrícola

Conseils de l'I.R.H.O. —216
I.R.H.O. Advice
Consejos del I.R.H.O.

Production de matériel végétal cocotier

Pépinière en sacs de plastique

I. — INTRODUCTION

L'élevage des plants de cocotier en sacs de plastique a débuté en 1969 en Côte-d'Ivoire, remplaçant la technique des pépinières de pleine terre. Ce document actualise les Conseils N° 106, publiés sur ce sujet dans le n° de mai 1971 d'*Oléagineux*.

Cette méthode a de nombreux avantages :

— développement plus rapide des plants en présence de fumures régulières épandues dans le sac ;
— manipulation facile des plants, mais volume plus important au transport d'où la nécessité d'avoir la pépinière proche du lieu de plantation ;
— maintien de la motte de terre contenant les racines, à la plantation.

Il en résulte l'obtention rapide de beaux plants, une meilleure reprise de ceux-ci en plantation et, par la suite, une mise à fleurs plus précoce (5,2 feuilles vivantes après 6 mois de plantation contre 3,5 pour les plants racines nues et 8,3 contre 6,6 après 1 an).

Cette technique ne présente pas de difficulté majeure mais demande des soins attentifs.

II. — MISE EN PLACE

Choix de l'emplacement.

La pépinière doit être située à proximité d'un point d'eau à débit suffisant pour assurer l'arrosage en toutes saisons et à proximité du germoir. Il est également souhaitable de retenir un site proche des lieux de plantations pour limiter les transports.

Le terrain doit être à peu près plat. Il est préalablement soigneusement dessouché, désherbé et aplani. Une pépinière d'un hectare peut recevoir environ 25 000 plants (dispositif à 60 × 60 cm en triangle).

Remplissage des sacs.

Les sacs utilisés sont en polyéthylène noir, résistant aux rayons ultraviolets, de 20/100 mm d'épaisseur et de dimension 40 × 40 cm sans soufflet. La moitié inférieure du sac est percée de 48 trous, de 4 à 5 mm de diamètre en trois rangées espacées de 5 cm, la plus basse étant à 5 cm au-dessus de la soudure du fond. Ils permettent l'évacuation de l'eau excédentaire.

FIG. 1. — **Remplissage des sacs** (*Fillings the bags* — Llenado de las bolsas).

Les sacs sont remplis aux deux tiers de terre prélevée dans l'horizon humifère superficiel du sol, bien débarrassé des débris végétaux (Fig. 1). Si le substrat est pauvre (sables lessivés), il peut être enrichi par l'apport de compost organique. Le sac rempli aux deux tiers contient 10 l de terre et pèse 16 à 18 kg.

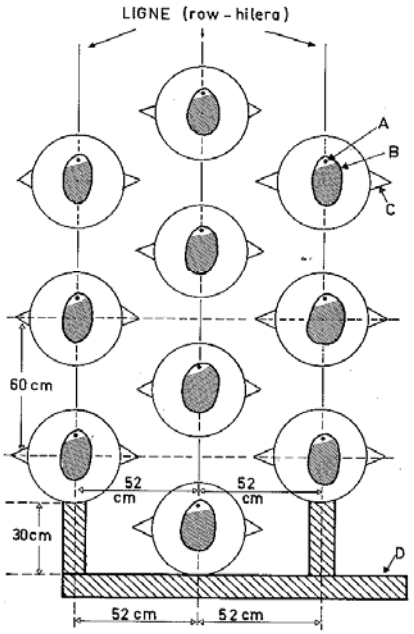

FIG. 2. — **Disposition de la noix dans les sacs de pépinières** (*Layout of nuts in nursery bags* — Disposición de la nuez en las bolsas de semillero).
A = **germe** (*sprout* — germen),
B = **noix** (*nut* — nuez),
C = **coin du sac que l'on rentre** (*corner of bag to be trucked in* — pico de la bolsa que se mete adentro),
D = **cadre gabarit en bois pour piquetage des lignes** (*wooden spacer for lining rows* — marco plantilla de madera para estacada hileras) — 60 × 60 cm.

Confection des planches.

La pépinière est divisée en planches d'égale surface dont les dimensions et la disposition sur le terrain sont fonction du système d'arrosage adopté.

Une fois la dimension des planches déterminée, on effectue le piquetage à l'aide d'un gabarit (Fig. 2). Les sacs sont alors distribués sur la planche, un sac contre chaque piquet et toujours du même côté (Fig. 3). Au moment de disposer les sacs, on prendra soin de rentrer les coins vers l'intérieur de façon à obtenir une base cylindrique ce qui donne une meilleure assise.

La durée de séjour des plants en pépinière dépend de plusieurs facteurs :

— conditions climatiques (ensoleillement),
— arrosage,
— substrat et fumures,
— variétés ou types d'hybrides.

Sur ce dernier point on peut indiquer qu'un Nain devra rester plus longtemps en pépinière (10 à 12 mois) qu'un Grand, que les hybrides de Nain Rouge Cameroun ou de Nain Vert de Guinée Equatoriale se développent moins vite que ceux obtenus avec les Nains Rouges ou Jaunes Malais. Il n'y a donc pas de règle générale mais on peut admettre qu'un plant bon à planter mesure 1 m 20 (de la noix à la plus jeune feuille ouverte en position normale) et 20 cm de circonférence au collet.

L'écartement des sacs dans la pépinière est, bien sûr, fonction de la durée de séjour des plants (un écartement trop faible donne des plants filés). On peut retenir les écartements suivants :

— jusqu'à 6 mois	60 × 60 cm,
— de 6 à 9 mois	80 × 80 cm,
— de 9 à 12 mois	100 × 100 cm.

FIG. 3. — **Mise en place des sacs** (*Setting out the bags* — Instalación de las bolsas).

III. — REPIQUAGE

Chaque sac rempli aux deux tiers reçoit une noix germée (Fig. 4), plantule dirigée toujours du même côté, et dont les racines ont été sectionnées au sécateur à 2 cm de la noix. La quantité de terre nécessaire est apportée pour compléter le remplissage jusqu'à 1 cm du bord. Cette terre

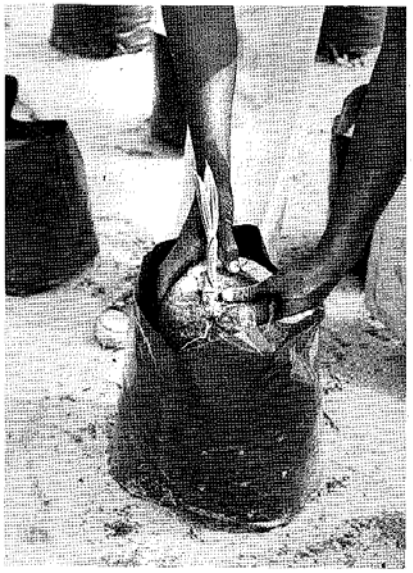

FIG. 4. — **Mise en place de la noix germée** (*Placing of the germinated nut in the bag* — Instalación de la nuez germinada).

FIG. 5. — **Remplissage de complément et tassement soigné de la terre** (*Topping up with earth and careful tamping* — Llenado de complemento y apisonamiento cuidadoso de la tierra).

est très soigneusement tassée pour éviter le déchaussement de la noix lors des arrosages (Fig. 5). Il faut veiller à ce que le collet du jeune plant ne soit jamais enterré. Seules sont repiquées en pépinière, les noix germées présentant une plantule normale (Conseils de l'I.R.H.O. N° 196) dont la taille est comprise entre 10 et 15 cm.

Le repiquage se fait par variété : une seule variété par planche. Les noix germées sont repiquées au fur et à mesure des germinations, au moins 1 fois par semaine afin de faciliter la sélection ultérieure des plants (Conseils de l'I.R.H.O. N° 197). Une pancarte située en bout de ligne indique la variété repiquée, la date de repiquage et le nombre de plants ainsi que le numéro de planche (Fig. 6).

FIG. 6. — **Etiquetage des planches** (*Marking the beds* — Etiquetado de las tablas).

IV. — MÉTHODES CULTURALES

Arrosage.

Les besoins en eau, les doses et les fréquences d'irrigation ont été définis pour les pépinières de palmiers en sacs de plastique (Conseils de l'I.R.H.O. N° 142). Pour le cocotier nous retiendrons les apports suivants à raison d'un cycle tous les deux jours :

— 8 mm par passage de 0 à 2 mois,
— 10 mm par passage de 2 à 4 mois,
— 12 mm par passage de 4 à 6 mois,
— 15 mm par passage à 6 mois et plus.

A partir de 6 mois, les besoins seront de 75 m^3 d'eau/j/ha de pépinière, il faut donc prévoir un débit horaire de 10 m^3/ha.

Il existe plusieurs dispositifs d'arrosage. Le choix doit tenir compte de plusieurs facteurs : facilité d'utilisation, de circulation entre les plants (entretien, fumures, traitements), d'accès pour les tracteurs ou camions au moment du transport des plants. L'investissement sera également fonction de la durée d'utilisation de la pépinière. Actuellement, la technique préconisée est celle par aspersion (Conseils de l'I.R.H.O. N^{os} 153 et 154) comprenant des installations fixes sur lesquelles se branchent des tuyaux souples alimentant des sprinklers (Fig. 7).

FIG. 7. — **Arrosage des pépinières de cocotiers** (*Watering the coconut nursery* — Riego de los semilleros de cocoteros).

Dans le cas de l'arrosage direct au jet, il faut éviter que de la terre soit entraînée hors du sac, et penser à en remettre éventuellement.

Entretien.

Avant la mise en place des sacs, on peut traiter le sol par un herbicide total type chlorate de soude (15-20 kg/ha) ou dalapon + 2-4 D. Ensuite le désherbage est exclusivement manuel tant dans les sacs que dans les interlignes.

Dans les pays où sévissent les maladies du jeune âge (blast et pourriture sèche), il est indispensable d'avoir une pépinière absolument sans graminées avec des abords immédiats propres sur au moins 10 m. Pour éviter un désherbage fréquent et coûteux des abords, il est conseillé d'y prévoir une plante de couverture dense type *Pueraria*.

Fumures.

Le jeune plant de cocotier dispose dans sa noix de réserves parfois importantes. Toutefois, un mois après le repiquage, les nouvelles racines émises sont aptes à utiliser les éléments nutritifs contenus dans le substrat et donc à bénéficier d'un apport d'engrais minéral.

Cette fumure est établie en fonction de la nature du substrat et de l'âge du plant.

Différents types de mélange peuvent être utilisés. Nous en citerons deux qui sont régulièrement utilisés sur la Station Marc-Delorme.

Mélange en poids

A		B	
Urée	= 1	Sulfate d'ammoniaque	= 2
Phosphate bicalcique	= 2	Phosphate bicalcique	= 2
Chlorure de potasse	= 2	Chlorure de potasse	= 2
Kiésérite à 33 p. 100	= 1	Kiésérite à 33 p. 100	= 1

Chaque plant reçoit tous les deux mois (en g) :

	A	B
— 1er mois	30	35
— 3e mois	60	70
— 5e mois	75	90
— 7e mois et suivants	75	90

Dans la mesure du possible il est préférable d'apporter l'engrais mensuellement. Les doses par plant seront alors les suivantes (en g) :

	A	B
— 1er mois	15	17,5
— 2e mois	15	17,5
— 3e mois	30	35
— 4e mois	30	35
— 5e mois	30	35
— 6e mois	37,5	45
— 7e mois et suivants	37,5	45

L'engrais épandu en couronne autour de la noix est mélangé à la terre de surface (Fig. 8) et suivi d'un arrosage le même jour.

Les engrais mélangés ont une très faible durée de conservation (réaction chimique) il faut donc effectuer le mélange juste avant la date prévue d'épandage. Certains phosphates naturels renferment du fluor, ils sont dans ce cas à proscrire totalement car ils entraînent des brûlures des feuilles.

Quinze jours avant la plantation, on conseille d'apporter une fumure d'appoint, dose maximale (75 ou 90 g selon le mélange en apport bimestriel ou, 37,5 ou 45 en apport mensuel).

V. — TRAITEMENTS

Une visite régulière de la pépinière est impérative si l'on veut pouvoir effectuer les traitements à temps.

Protection contre fourmis et termites.

Une solution de 15 g de Soldrine 40 (à 40 p. 100 d'aldrine) dans 10 l d'eau pour 400 plants, soit 25 cm^3/plant, est versée sous le sac. Si les termites s'attaquent à la noix, une dose supplémentaire est appliquée sur la bourre.

Protection contre les cochenilles et pucerons.

On pulvérise à la face inférieure des feuilles, une solution de 100 cc de Systoate (à 40 p. 100 de diméthoate), additionnée d'un mouillant dans 100 l d'eau. Deux traitement à 10 j d'intervalle sont nécessaires pour éliminer totalement les cochenilles.

Protection contre les acariens.

Une solution de 400 g de soufre micronisé par hl d'eau (60 g pour 15 l d'eau) est pulvérisée sur les acariens.

Remarque. *— Pour les traitements au Systoate ou au soufre micronisé, il est recommandé de traiter aux heures fraîches pour éviter des brûlures.*

Protection contre les défoliateurs (Pyrales, etc.).

Les traitements se font en pulvérisant sur tout le feuillage une solution de carbaryl contenant 20 g de p.c. (Prosevor) dans 15 l d'eau. En saison sèche si la pépinière n'est pas irriguée par aspersion, le produit se concentre

FIG. 8. — **Incorporation de l'engrais au substrat du sac** (*Mixing of fertilizer into the substrate in the bag* — Incorporación del abono en el substrato de la bolsa).

plus longtemps sur les feuilles et peut entraîner des brûlures, il est alors conseillé de réduire la dose à 15 g ou d'arroser les feuilles le lendemain du traitement. On peut également faire des traitements préventifs pour du matériel précieux ou si les risques d'attaques sont connus.

Protection contre le blast et la pourriture sèche.

Ces deux maladies mortelles du jeune âge sont transmises par des insectes vivant sur les graminées. Il n'existe pas de moyen de lutte efficace à 100 p. 100, mais les méthodes suivantes permettent de réduire nettement les pertes :

— Eradication des graminées dans la pépinière et aux abords (voir « Entretien »).

— Apport mensuel de 4 g de Témik (granulés à 10 p. 100 d'aldicarbe) par plant à partir du jour de repiquage. Les granulés sont épandus en couronne autour de la noix et enfouis. Ce produit dangereux pour l'homme doit être manipulé avec précaution (gants et masque, Fig. 9).

FIG. 9. — **Epandage et incorporation de Témik** (*Spreading and forking in Temik* — Aplicación e incorporación de Temik)

— Ombrière : c'est une méthode coûteuse qui gêne le développement des plants. Elle est néanmoins conseillée si l'on n'utilise pas le Témik dans les régions sujettes aux maladies, ou pour du matériel végétal particulièrement précieux.

Protection contre les maladies fongiques.

Les maladies fongiques les plus répandues sont dues à *Helminthosporium* et *Pestalozzia*. Les différentes variétés et les hybrides de cocotier ne présentent pas tous la même sensibilité à ces champignons.

Dans les régions où des risques d'attaques existent, on fera des traitements préventifs deux fois par mois en pulvérisant sur les deux faces des feuilles une solution contenant 30 g de Dithane M45 ou de Daconil dans 15 l d'eau. Il est préférable d'alterner ces deux produits. Le traitement curatif en cas de fortes attaques doit être pratiqué toutes les semaines. Il faut veiller à ce que la pulvérisation soit suffisante pour être efficace (feuilles bien mouillées sur les deux faces).

On peut également en complément du traitement, couper les feuilles trop atteintes, voire éliminer les plants, les transporter dans un sac pour éviter de disséminer les spores et les brûler hors de la pépinière. L'attaque commençant souvent sur un petit nombre de plants, cette technique permet de détruire les foyers de dissémination.

Suivi des travaux.

Il est indispensable de suivre avec soin les travaux de la pépinière et de connaître les résultats finals. Pour cela, le pépiniériste tiendra des fiches (Fig. 10), 1 par planche, sur lesquelles il inscrira :

— Fumure = date et dose.

— Traitements = date, produit et dose.

— Résultats finals = nombre de plants morts et causes, nombre de plants éliminés après sélection (Conseils de l'I.R.H.O. N° 197), et nombre de plants bons à planter.

— Observations particulières (arrêt de l'irrigation pour panne, etc.).

Ces données permettront de juger de la valeur du travail fourni et, en cas de mauvais résultats, d'en trouver les causes et d'y remédier.

FIG. 10. — Fiche pépinière

N° de planche : Date repiquage :					Nombre de plants : Variété :				Date de plantation :
Date	Fumure (dose)				Date	Traitements (produit et dose)			
	N	P	K	Mg		Termites	Cochenilles	Pyrales	Helmintho.
Nombre de plants morts = pourcentage =									
Nombre de plants anormaux = pourcentage =									
Nombre de plants plantables = pourcentage =									
Observations (Arrosage, traitements, etc.)									

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Préparation des plants pour la plantation.

Les plants sélectionnés sont préparés la veille du transport pour le champ. Il recevront un arrosage abondant pour assurer une réserve d'eau et mieux tenir la motte de terre. On doit manipuler les plants avec soin pour éviter de les déchausser ou de déchirer le sac. Si les racines ont traversé le sac, il faut, avant tout déplacement, les couper à la machette.

Toute manipulation des plants se fait en soulevant le sac et jamais en saisissant le collet (déchaussement).

La technique de plantation a fait l'objet des Conseils de l'I.R.H.O. N° 189.

CONCLUSIONS

La méthode des pépinières en sacs de plastique représente un progrès agronomique très important permettant d'obtenir des plants bien développés dont la reprise en plantation est excellente. Son coût plus élevé par rapport à la méthode pleine terre est largement compensé par la réalisation de plantations homogènes avec des pertes de reprise très réduites (< 1 p. 100) et un développement plus rapide assurant une meilleure précocité. Les plants ne subissant pas de traumatisme à la plantation sont également moins sujets aux attaques de certains insectes (termites, cochenilles).

W. WUIDART.

Production of coconut planting material

The polybag nursery

I. — INTRODUCTION

The raising of coconut plants in polybags started in 1969 in the Ivory Coast, superseding the technique of field nurseries. This article brings up to date I.R.H.O. Advice N° 106 on this subject, published in the May 1971 issue of Oleagineux.

This method has many advantages :

— the plants develop better with the regular fertilizer dressings applied in the bag ;

— it is easier to handle the plants ; the disadvantage is that there is more bulk to transport hence the need to have the nursery near the site of planting ;

— the earth ball containing the roots is intact at field planting.

All this results in the rapid obtainment of fine plants, better rooting in the field and earlier flowering later on (5.2 living leaves 6 months after planting against 3.5 for bare-root plants, and 8.3 against 6.6 after 1 year).

The technique offers no major difficulties, but does require care and attention.

II. — SETTING UP THE NURSERY

Choice of a site.

The nursery should be sited near a water point of sufficient discharge to permit watering at all times of the year ; it should also be close to the seed-bed. Moreover, to cut down transport, it should be in the proximity of the site of field planting.

The land should be practically flat, and it is stumped up, weeded and levelled beforehand. A 1-ha nursery can take 25,000 plants spaced at 60 × 60 m in triangles.

Filling the bags.

The bags are made of black polyethylene, resistant to ultraviolet rays, 20/100 mm thick, size 40 × 40 cm without gussets. The lower half is pierced with 48 holes, ∅ 4-5 mm, in 3 rows 5 cm apart ; the lowest row is 5 cm above the bottom seam. These perforations allow excess water to drain off.

The bags are two-thirds filled with earth taken from the humiferous topsoil and cleared of plant debris (Fig. 1). If the substrate is poor (leached sands), it can be enriched with organic compost. When filled to this level, the bag contains 10 l of earth and weighs 16-18 kg.

Making the beds.

The nursery is divided into beds of equal area, the exact size and lay-out on the land depending on the watering system adopted.

Once the bed size is fixed, lining is done with the aid of a width gauge (Fig. 2). The bags are laid out on the bed, a bag against each stake, always the same side (Fig. 3). When the bag is set down, the bottom corners must be tucked in to round the base so that it sits more firmly.

The time the plants spend in the nursery depends on several factors :

— meteorological conditions (sunshine),
— watering,
— substrate and fertilization,
— varieties or types of hybrids.

As regards this last point, it can be said that a Dwarf should stay longer in the nursery (10-12 months) than a Tall, and that hybrids of Cameroon Red Dwarf or Guinea Green Dwarf develop more slowly than those made with Red or Yellow Malayan Dwarfs. So there is no general rule, but it can be accepted that a plant fit for planting will measure 1.20 m (from the nut to the youngest leaf unfurled in a normal position) and be 20 cm in girth.

Spacing of the bags, of course, is in function of the time the plants remain in the nursery (if they are too close together they will bolt). The following spacings can be retained :

— up to 6 months	*60 × 60 cm,*
— 6-9 months	*80 × 80 cm,*
— 9-12 months	*100 × 100 cm.*

III. — PRICKING OUT

Each bag two-thirds filled receives a germinated nut (Fig. 4), the sprout always on the same side ; the roots are trimmed with a shears to within 2 cm of the nut. Enough soil is added to fill the bag to within 1 cm of the edge, and it is then carefully tamped down so that the nut is not bared during watering (Fig. 5). Care must be taken not to earth up the collar of the young plant. Only germinated nuts with a normal sprout (I.R.H.O. Advice N° 196) 10-15 cm long are pricked out in the nursery.

They are pricked out by variety — only one variety in each bed — as and when they germinate, and at least once a week so that subsequent culling of the plants is made easier (I.R.H.O. Advice N° 197). A board at the end of the bed indicates the variety, the date of pricking out, the number of plants and the bed number (Fig. 6).

IV. — METHODS OF CULTIVATION

Watering.

Water requirements, rates and frequency of irrigation have been defined for oil palm polybag nurseries (I.R.H.O. Advice N° 142).

For the coconut we suggest the following quantities at the rate of one round every other day :

— 0-2 months	8 mm/round,
— 2-4 months	10 mm/round,
— 4-6 months	12 mm/round,
— over 6 months	15 mm/round.

From 6 months onwards the requirement will be 75 m^3 of water/day per ha of nursery, so that the hourly discharge of the water supply should be 10 m^3/ha.

Several watering systems are available, and the choice must take certain factors into account : ease of use, of circulation between the plants (maintenance, fertilization, treatments) or access for tractors or trucks for plant transport. The capital investment will also depend on the length of time for which the nursery will be in use. At the moment the technique recommended is spray irrigation (I.R.H.O. Advice N°s 153 and 154) which includes fixed elements to which are connected flexible piping feeding the sprinklers (Fig. 7).

In the case of direct watering by jet, care must be taken not to wash the earth out of the bag ; neither must it be forgotten to top it up when necessary.

Maintenance.

Before the bags are set out, the ground can be treated with a total herbicide such as sodium chlorate (15-20 kg/ha) or Dalapon + 2-4 D. After that, weeding is done by hand only, both in the bags and between the rows.

In countries where juvenile diseases are rife (blast and dry rot), it is essential to have a completely grass-free nursery, and keep the surroundings clean over a width of at least 10 m. To avoid frequent and costly weeding of the latter, it is recommended that a dense cover plant of the Pueraria *type should be planted.*

Fertilization.

The young coconut has reserves in its nut which are sometimes quite considerable. However, a month after pricking out the newly-emitted roots are capable of using the nutrients contained in the substrate and therefore of profiting from a fertilizer dressing.

This fertilization is worked out in virtue of the nature of the substrate and the age of the plant.

Various compounds can be used ; we will mention two used regularly on the Marc Delorme Station.

Proportions

A		B	
Urea	= 1	Ammonium sulphate	= 2
Bicalcic phosphate	= 2	Bicalcic phosphate	= 2
Potassium chloride	= 2	Potassium chloride	= 2
Kieserite at 33 p. 100	= 1	Kieserite at 33 p. 100	= 1

Every other month each plant gets (in g) :

	A	B
— 1st month	30	35
— 3rd month	60	70
— 5th month	75	90
— 7th month and after	75	90

As far as possible it is better to fertilize monthly. In that case rates per plant are as follows (in g) :

	A	B
— 1st month	15	17.5
— 2nd month	15	17.5
— 3rd month	30	35
— 4th month	30	35
— 5th month	30	35
— 6th month	37.5	45
— 7th month and after	37.5	45

The fertilizer is spread in a ring round the nut and forked into the topsoil (Fig. 8) ; the bag is watered the same day.

Once mixed, fertilizers only keep for a very short time (chemical reactions), so that mixing must be done just before the date of spreading. Certain natural phosphates contain fluorine and should be proscribed absolutely, as they cause burns on the leaves.

It is recommended that an extra dressing be given a fortnight before field planting, at the maximum rate (which will be 75 ou 90 g according to the compound in 2-months application, or 37.5 or 45 monthly).

V. — TREATMENTS

Regular inspection of the nursery is indispensable if treatments are to be given in time.

Protection against ants and termites.

A solution of 15 g Soldrine 40 (at 40 p. 100 aldrin) in 10 l water for 400 plants, or 25 cm^3/plant, is poured under the bag. If termites attack the nut, an extra dose is applied in the husk.

Protection against scales and aphids.

Spray the underside of the leaves with a solution of 100 cc Systoate (at 40 p. 100 dimethoate) plus a wetting agent in 100 l water. Two treatments 10 days apart are needed to get rid of scales completely.

Protection against mites.

A solution of 400 g micronised sulphur per hl/water (60 g for 15 l) is sprayed on the mites.

Note. — It is advisable to give Systoate or micronised sulphur treatments in the cool hours to avoid burns.

Protection against leaf-eaters (pyralis, etc.).

The whole foliage is sprayed with a solution of carbaryl containing 20 g c.p. (Prosevor) in 15 l water. In the dry season, if the nursery is not spray irrigated, the product remains concentrated on the leaves for longer and can cause burns ; to avoid this the rate should be reduced to 15 g or the leaves watered the day after treatment. Preventive treatments can also be given for precious material or if there are known risks of attack.

Protection against blast and dry rot.

These two lethal juvenile diseases are transmitted by insects living in the grasses. There is no means of control 100 p. 100 effective, but the following methods will cut down losses considerably :

— Eradication of grasses in the nursery, and its surroundings (see « Maintenance »).

— Monthly application of 4 g Temik (pellets at 10 p. 100 aldicarbe) per plant starting on the day of pricking out ; the pellets are spread in a ring round the nut and forked in. This product is dangerous to man and must be handled with care (gloves and mask, Fig. 9).

— Shading : this is costly and hampers plant development. However, it is advised if Temik is not used in regions subject to diseases or for particularly precious planting material.

Protection against fungus diseases.

The most widespread fungus diseases are due to Helminthosporium *and* Pestalozzia. *The different coconut varieties and hybrids are not all equally sensitive to these fungi.*

In areas where there is a risk of attack, preventive treatments should be given twice a month, spraying both sides of the leaves with a solution of 30 g Dithane M45 or Daconil in 15 l water. it is preferable to alternate the two products. Curative treatment in case of heavy attacks should be practised every week. Care must be taken to see that spraying is abundant enough to be effective — both surfaces of the leaf should be thoroughly moistened.

To back up the treatment, leaves too badly attacked can be cut, or even whole plants eliminated ; they should be taken away in a sack to avoid disseminating spores and burned off the nursery. Attacks often start on a small number of plants, so this operation often destroys the focus.

Follow-up of work.

It is essential that all the tasks in the nursery should be followed up with care and their final results known. To this end, the nursery foreman will keep record sheets by bed (Fig. 10), on which he will enter :

— Fertilizers : date and rate,

— Treatments : date, product and rate,

— Final results : number of dead plants and cause, number of plants culled (I.R.H.O. Advice N° 197), number fit for planting,

— Special remarks : (irrigation stopped because of breakdown, etc.).

Bed Nº : Date pricked out :					Nº of plants : Variety :				Date of planting :
Date	Fertilizer (rate)				Date	Treatments (product and rate)			
	N	P	K	Mg		Termites	Scales	Pyralis	Helmintho.
Nº of dead plants = p. 100 =									
Nº of abnormal plants = p. 100 =									
Nº of plantable plants = p. 100 =									
Remarks (Watering, treatments, etc.)									

FIG. 10. — Nursery Record Sheet

This information will enable the value of the work to be judged and, if the results are poor, the cause to be sought and remedied.

Preparation of plants for field planting.

The plants selected are prepared on the eve of their transport to the field. They are abundantly watered to ensure a moisture reserve handled with care to avoid baring them or tearing the bag. If the roots have grown through the bag, they must be cut with a machete before being moved at all.

All handling should be done by the bag and never by holding the plant by the collar, which will unearth it.

The planting technique was dealt with in I.R.H.O. Advice Nº 189.

CONCLUSIONS

The polybag nursery method is a very considerable step forward agronomically, providing well-developed plants rooting excellently when field planted. It is more costly than field nurseries, but this is amply compensated by the homogeneous plantings which result, with very reduced rooting losses (< 1 p. 100) and quicker development, making for better precocity. Since the plants suffer no transplanting shock, they are also less subject to attacks by certain insects such as termites and scales.

W. WUIDART

Producción de material vegetal de cocotero

Semillero en bolsas de plástico

I. — INTRODUCCIÓN

El cultivo de plantones de cocotero en bolsas de plástico empezó en 1969 en Costa de Marfil, sustituyendo a la técnica de los semilleros en la tierra. Este documento es una actualización de los Consejos nº 106, publicados sobre el tema en el número de *Oléagineux* de mayo 1971.

Este método ofrece muchas ventajas :

— permite el desarrollo más rápido de plantones cuando se esparció regularmente abonos en la bolsa ;

— los plantones son más fáciles de manipular, pero el volumen que hay que transportar es mayor, por lo que el semillero tiene que localizarse cerca del lugar de siembra ;

— se mantiene el terrón que contiene las raíces, en la siembra en sitio definitivo.

Esto produce rápidamente plantones bonitos, además de un mejor arraigo en la plantación, y más tarde florecen más temprano (5,2 hojas vivas a los 6 meses de siembra, cuando en los plantones de raíces desnudas sólo hay 3,5, y después de un año hay 8,3 hojas vivas, frente a 6,6).

Esta técnica no ofrece ninguna dificultad de importancia, pero requiere cuidados atentos.

II. — SIEMBRA

Elección de la ubicación.

El semillero debe estar situado en las proximidades de una fuente de agua con caudal suficiente para asegurar el riego en todas las estaciones, y también cerca del germinador. Además más vale elegir un sitio próximo a la plantación, para reducir los transportes.

El terreno tiene que ser más o menos llano. Hay que destoconarlo previa y cuidadosamente, deserbándolo y aplanándolo. Un semillero de una hectárea puede contener unos 25 000 plantones (dispositivo de 60 × 60 cm en triángulo).

Llenado de las bolsas.

Las bolsas serán de polictileno negro, resistente a los rayos ultraviolados, de 20/100 mm de espesor y de 40 × 40 cm sin fuelle. La mitad inferior de la bolsa lleva 48 agujeros, de 4 a 5 mm de diámetro, que forman tres filas con 5 cm de distancia, llegando la más baja a 5 cm de la soldadura del fondo. Permiten que el excedente de agua se escurra.

Se llenan las bolsas hasta los dos tercios con tierra tomada en el horizonte humífero superficial del suelo, eliminándose los restos vegetales (Fig. 1). Si el substrato es pobre (arenas lixiviadas), se puede enriquecerlo mediante la aportación de compost orgánico. La bolsa llena en los dos tercios contiene 10 l de tierra y pesa de 16 a 18 kg.

Confección de tablas.

El semillero queda dividido en tablas de igual superficie cuyas dimensiones y disposición en el campo dependen del sistema de riego adoptado.

Después de establecida la dimensión de las tablas, se procederá a la estacada utilizando una plantilla (Fig. 2). Entonces se distribuyen las bolsas en la tabla, apoyándose una bolsa contra cada estaca, siempre del mismo lado (Fig. 3). En el momento de disponer las bolsas, se tomará mucho cuidado de meter los picos hacia adentro, a fin de obtener una base cilíndrica, lo cual siempre da un mejor asiento.

El término de duración de los plantones en el semillero depende de varios factores, que son :

— las condiciones de clima (insolación),
— el riego,
— el substrato y el abonado,
— las variedades o los tipos de híbridos.

En cuanto a este último punto, conviene indicar que un Enano deberá quedar más tiempo en el semillero (10 a 12 meses) que un Alto, que los híbridos Enano Rojo Camerún o Enano Verde de Guinea Ecuatorial se desarrollan más despacio que los que se

Annex 5

Conseils de l'I.R.H.O. – 189

Oleagineux 1979 vol. 34 n°1 M. POMMIER

Plantation des cocotiers élevés en sacs de plastique

Cette note actualise les « Conseils de l'I. R. H. O. » n° 117 (1) qui décrivaient la technique à employer pour la conduite des pépinières de cocotiers en sacs de plastique. Elle a pour objet de décrire les diverses opérations qui permettent d'assurer rapidement la reprise du jeune plant et d'accélérer sa croissance.

I. — TRAVAUX PRÉPARATOIRES A LA PLANTATION

En pépinière.

Dans le mois qui précède la plantation, il faut s'assurer du parfait état sanitaire des jeunes cocotiers et procéder à la sélection selon les normes décrites dans les « Conseils » n°s 113, 114 et 116 (2).

La veille, ou le jour, du transport sur le champ, les plants sont copieusement arrosés pour donner une meilleure tenue à la motte et assurer une réserve d'eau pour plusieurs jours.

Sur le terrain.

A l'emplacement de chaque cocotier, un rond de 1 m de rayon est débarrassé de toute végétation et bien nivelé.

II. — TRANSPORT

Les plants sont chargés sur une remorque de tracteur ou un camion, en 2 lits. La capacité d'une remorque de tracteur ordinaire est de 150-200 plants (25 plants/m²). Les plants sont transportés sur la parcelle à planter et déposés à côté de chaque piquet de plantation (le tracteur roulant au milieu de l'interligne). Toutes les manipulations doivent se faire en tenant le cocotier par le sac de plastique et non par le collet.

III. — MISE EN PLACE

Cette opération est réalisée, le plus rapidement possible, au plus tard 2 jours après la sortie de pépinière.

Il faut creuser un trou dont l'ouverture est légèrement plus grande que le sac et la profondeur telle que la terre recouvre de 5 cm le sommet de la noix (Fig. 1).

Puis, les 2 coins inférieurs du sac sont coupés à la machette (Fig. 2) et le fond est fendu (Fig. 3). Le cocotier est alors soulevé et posé au fond du trou (Fig. 4 et 5). L'espace entre le sac et la paroi du trou est rempli de terre légèrement tassée. Les côtés du sac sont coupés à la machette (Fig. 6), le plastique est enlevé, la terre de remplissage est tassée fortement avec les pieds en veillant à ne pas casser la motte qui contient les racines, on complète ensuite le remplissage jusqu'au niveau du sol, ou légèrement au-dessous de ce niveau dans les pays où soufflent des vents forts. La terre apportée est de nouveau bien tassée. L'excédent de terre est réparti autour du cocotier, de manière à former une cuvette.

IV. — MÉCANISATION DE LA TROUAISON DANS LES SOLS LOURDS

Dans les sols lourds et compacts ou gravillonnaires la trouaison est un travail difficile. On peut augmenter le rendement des travailleurs en réalisant cette trouaison au moyen d'une tarière à moteur actionnée par la prise de force d'un tracteur. Puissance du tracteur : 30-35 CV pour une tarière de 45 cm de diamètre.

V. — NORMES DE RENDEMENT

Dégagement des ronds : dans une couverture de légumineuses, le contrat journalier est de 150 ronds.

Chargement des cocotiers et dépôt sur le terrain : une équipe de 4 hommes peut charger ou décharger 1 500 cocotiers/jour.

Mise en place, avec *trouaison manuelle* : un manœuvre peut planter 60 à 80 cocotiers/jour ; avec *trouaison mécanique* : un conducteur de tracteur bien entraîné peut réaliser 600 trous/jour. Dans ce cas, un manœuvre peut planter 150 cocotiers/jour.

CONCLUSION

La plantation des jeunes cocotiers élevés en sacs de plastique est relativement simple mais elle doit respecter certains principes pour assurer aux plants les meilleures conditions de développement et de précocité.

M. POMIER.

(1) Cf. *Oléagineux*, n° de mai 1972.
(2) Cf. *Oléagineux*, n°s de janvier, février et avril 1972.

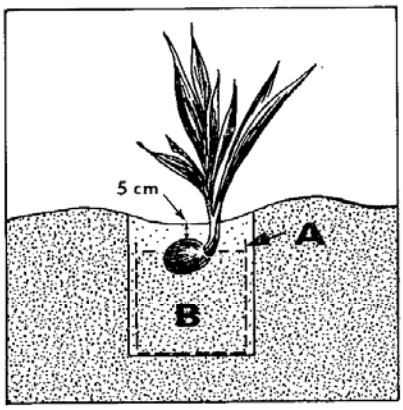

FIG. 1. — **Sac en place** (*Bag in place* — Bolsa instalada) :

A. — Sac de plastique à enlever (*plastic bag, bo be removed* — bolsa de plástico para sacar) ;

B. — Motte de terre contenue dans le sac *(earth ball contained in the bag* — cepellón contenido en la bolsa).

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

Planting of Coconut Palms in plastic Bags

This note brings « Conseils » no. 117 (1) up to date. That article dealt with the technique to be employed in managing coconut palm nurseries in plastic bags. It is our object to describe the various operations which will insure quick rooting of the young plant and speed its growth.

I. — PREPARATION FOR PLANTING

In the nursery.

During the month preceding planting, the perfect sanitary condition of the young palms must be verified, and they must be culled according to the criteria described in « Conseils » nos. 113, 114 and 116 (2).

The day before their transport to the field, or the same day they must be copiously watered to keep the earth ball firm, and to provide a water reserve over several days.

In the field.

Around each planting hole, a radius of 1 meter is cleared of all vegetation and well levelled.

II. — TRANSPORT

Plants are loaded onto a tractor trailer or truck in two layers. The capacity of an ordinary tractor trailer is 150-200 plants (25 plants/m²). The plants are transported to the plot to be planted and each deposited beside a planting stake (the tractor moves down the middle of the interline). The plant must always be handled by the plastic bag, not by the collar.

III. — PLANTING

This operation is carried out as rapidly as possible, at the latest two days after leaving the nursery.

A hole is dug, its mouth slightly larger than the bag, its depth such that the earth will cover the top of the nut by 5 cms (Fig. 1).

Then, the two lower corners of the bag are cut with a machete (Fig. 2) and the bottom is slit (Fig 3). The coconut palm is then lifted and placed at the bottom of the hole (Fig. 4 and 5). The space between the bag and the hole is filled with earth lightly tamped down. The sides of the bag are cut with the machete (Fig. 6), the plastic removed, and the filled earth stamped down firmly by foot, care being taken not to break the earth ball containing the roots. The hole is then filled in up to soil level or slightly higher in countries where the wind is strong. The earth applied is again tamped down firmly and the excess is spread around the coconut palm, forming a basin.

IV. — MECHANIZATION OF HOLING IN HEAVY SOILS

In heavy, compact or gravelly soils, holing is hard work. The yield of the workers can be increased by holing with a motor auger run off a tractor power point. For a 45-centimeter auger a 30-35 h. p. tractor is required.

V. — OUTPUT NORMS

***Clearing the circles** : with a legume cover, the daily contract is 150 circles.*

***Loading of coconut palms and deposit on the land** : a team of 4 men can load or unload 1,500 coconut palms/day.*

***Planting** : manual holing — one worker can plant 60-80 coconut palms/day ; mechanized holing — a well-trained tractor driver can dig 600 holes/day. In this case, a worker can plant 150 coconut palms/day.*

CONCLUSION

Planting of young coconuts grown in plastic bags is relatively simple, but certain principles must be respected in order to insure the best conditions for development and precocity in the plants.

M. POMIER.

(1) *Cf. Oléagineux*, nº of May 1972.
(2) *Cf. Oléagineux*, nº of January, February and April 1972.

Siembra de cocoteros criados en bolsas de plastico

En la presente nota se actualiza el « Conseils de l'I. R. H. O. » nº 117 (1) en el que describimos la técnica a emplearse en el manejo de los semilleros de cocoteros en bolsas de plástico. En ésta nos proponemos describir las diversas operaciones que permiten el arraigo rápido del jóven plantón y la activación del crecimiento.

I. — TRABAJOS PREVIOS A LA SIEMBRA

En el semillero.

Durante el mes que precede a la siembra hay que verificar el perfecto estado de sanidad de los cocoteros jóvenes, procediendo a la selección con arreglo a las normas descritas en los consejos nºs 113, 114 y 116 (2).

La víspera o al propio dia del transporte al campo, se debe regar los plantones abundantemente para dar mayor firmeza al cepellón y asegurarle una reserva de agua para varios días.

En el campo.

En la ubicación de cada cocotero, se despeja toda la vegetación y se nivela perfectamente un círculo de 1 m de radio.

II. — TRANSPORTE

Se cargan los plantones en un volquete de tractor o en un transporte, en dos capas. En el volquete de un tractor ordinario caben de 150 a 200 plantones (25 plantones/m²). Se trans-

(1) Vean *Oléagineux*, mayo 1972.
(2) Vean *Oléagineux*, enero, febrero, april 1972.